



## Spectrum Unification

By Tom Kidd - January-March 2016

The United States uses a bifurcated process to manage its electromagnetic spectrum resources. The National Telecommunications and Information Administration (NTIA) manages spectrum for federal government users, including the military departments of the Army, Navy and Air Force. The Federal Communications Commission (FCC) manages spectrum for non-federal users, including state and local governments, commercial industry, and private citizens. Two separate agencies manage one common resource. In this article, we address the option of the unification of the electromagnetic spectrum while maintaining the protections of bifurcation.

In its simplest form, spectrum management is accomplished by allocating separate parts of the spectrum to either federal users or non-federal users. For example, the frequency band in Figure 1 is allocated exclusively for federal users, while the next frequency band shown in Figure 2 is allocated exclusively for non-federal spectrum users. The subsequent frequency band, shown in Figure 3, is again allocated to federal users. Alternating the frequency bands between federal and non-federal users is a simple method of sharing the electromagnetic spectrum.

Data for the tables in the examples, and the footnotes referenced, are from the NTIA's "Manual of Regulations and Procedures for Federal Radio Frequency Management (Redbook), May 2014 Revision."

Other bands of the radio frequency spectrum are allocated to both federal and non-federal users, but for different purposes. For example, the band shown in Figure 4 is allocated for federal radar users and for non-federal amateur radio operators. In this example, federal operators have primary access over non-federal operators. In other shared bands, non-federal users have primary access over federal government users; and in other bands, primary and secondary operations are allocated to both federal and non-federal users. These are indicated within the national Table of Frequency Allocations from the Manual of Regulations and Procedures for Federal Radio Frequency Management (Redbook), by specifying the operations in all upper case letters for primary, or a mix of upper and lower case letters for secondary allocation, as shown in Figure 5.

Spectrum unification, where both federal and non-federal users have equal access to the spectrum, is currently in place within the United States in several frequency bands. For example, the band shown in Figure 6 is allocated for both federal and non-federal aeronautical telemetry. Within the allocation table, unified bands are easily identified since there is no line dividing federal and non-federal allocation.

In the Figure 6 example, no spectrum unification action would be needed. The band is already unified. In other bands, such as that shown in Figure 7, which is currently allocated exclusively for federal use, or Figure 8, which shows the bands currently allocated exclusively to non-federal use, unification may be as simple as allowing equal access by both federal and non-federal users. These bands would be unified by removing their exclusivity.

In bands where both federal and non-federal users share access, but one user has additional services allocated, as illustrated in Figure 9, it may be practical to merge the allocation and enable both federal and non-federal systems access to all allocations. Or, in cases where there is a need to limit allocation, the restriction could be changed from an allocation to a footnote. For example, many frequency bands contain \*footnotes that apply only to Federal (G) or non-Federal (NG) operations. Versions of these types of footnotes could be used to provide specific restrictions or protections if the spectrum transitions to unification.

These footnotes could also be used to maintain the full effect of bifurcation while still enabling full spectrum unification. Examples of these type footnotes are currently used to further limit spectrum allocations within either a federal or non-federal exclusive frequency band. For example, while some frequency bands may be allocated for federal use, the footnote G27 further allocates access specifically to military operations. Similar footnotes could be applied in those unique circumstances where it would be necessary to maintain the protections of bifurcation within a unified spectrum.

This article is not intended to advocate either for or against spectrum unification. A total shift from spectrum bifurcation may not be practical. However, as summarized in this article, much of the

| United States Table         |                   |
|-----------------------------|-------------------|
| Federal Table               | Non-Federal Table |
| 38 25-39<br>FIXED<br>MOBILE | 38 25-39          |

**Fig 1**

Figure 1. All examples and tables shown are taken from the NTIA's "Manual of Regulations and Procedures for Federal Radio Frequency Management (Redbook), May 2014 Revision"

| United States Table |                               |
|---------------------|-------------------------------|
| Federal Table       | Non-Federal Table             |
| 39-40               | 39-40<br>LAND MOBILE<br>NG124 |

**Fig 2**

Figure 2.

| United States Table      |                   |
|--------------------------|-------------------|
| Federal Table            | Non-Federal Table |
| 40-42<br>FIXED<br>MOBILE | 40-42             |

**Fig 3**

Figure 3.

| United States Table              |                          |
|----------------------------------|--------------------------|
| Federal Table                    | Non-Federal Table        |
| 420-450<br>RADIOLOCATION G2 G129 | 420-450<br>Amateur US270 |

**Fig 4**

Figure 4.

| United States Table   |  |
|---|--|
| Federal Table   | Non-Federal Table  |
| 13 75-14<br>RADIOLOCATION<br>Standard frequency and time<br>signal-satellite (Earth-to-space)<br>Space research | 13 75-14<br>FIXED-SATELLITE<br>(Earth-to-space)<br>Standard frequency and time<br>signal-satellite (Earth-to-space)<br>Space research<br>Radiolocation |

**Fig 5**

Figure 5.

| United States Table                          |                   |
|--|-------------------|
| Federal Table                                | Non-Federal Table |
| 1435-1525<br>MOBILE (aeronautical telemetry) |                   |

**Fig 6**

Figure 6.

| United States Table  |                   |
|--|-------------------|
| Federal Table  | Non-Federal Table |
| 2700-2900<br>METEOROLOGICAL AIDS<br>AERONAUTICAL RADIONAVI-<br>GATION<br>Radiolocation 1 | 2700-2900         |

**Fig 7**

Figure 7.

| United States Table |  |
|---------------------|--|
| Federal Table       | Non-Federal Table                                      |
| 6525-6700           | 6525-6700<br>FIXED<br>FIXED-SATELLITE (Earth-to-space) |

**Fig 8**

spectrum is nearly unified today, and with a measured approach, the electromagnetic spectrum could be further unified.

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Figure 8.

| United States Table   |                           |
|---|---------------------------|
| Federal Table   | Non-Federal Table         |
| 2360-2390<br>MOBILE US276<br>RADIOLOCATION G2 G120<br>Fixed | 2360-2390<br>MOBILE US276 |
| Fig 9   |                           |

Figure 9.

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